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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/807,413	03/24/2004	Taichiroo Konno	035532-0140	3864

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 FOLEY AND LARDNER LLP  
 SUITE 500  
 3000 K STREET NW  
 WASHINGTON, DC 20007

EXAMINER
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MONDT, JOHANNES P

ART UNIT	PAPER NUMBER
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3663

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/28/2007	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/807,413	<b>Applicant(s)</b> KONNO ET AL.	
	<b>Examiner</b> Johannes P. Mondt	<b>Art Unit</b> 3663	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 28 December 2006.
- 2a) ☐ This action is FINAL.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) 12,14,16,18 and 20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-11,13,15,17,19 and 21-23 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                 | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date: _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                        | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date: _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Response to Amendment***

Amendment filed 12/28/06 in Response to office action mailed 12/01/06 (Notice of Non-Responsive Amendment), correcting a Non-Responsive Election filed 9/22/06, in conjunction with Amendment with Remarks filed 6/12/06 forms the basis for this office action. Applicant substantially amended all claims 1-23 through substantial amendment of claim 1.

Comments on Remarks submitted with said Amendment filed 6/12/06 are included below under "Response to Arguments".

### ***Election/Restrictions***

Applicant, in Response filed elected the 9<sup>th</sup> Embodiment (Figure 7) without traverse and indicated claims 1-11, 13, 15, 17, 19 and 21-23 to read on the elected Species. Accordingly, claims 12, 14, 16, 18 and 20 are herewith being withdrawn from consideration. Examiner respectfully disagrees with Applicant's allegation on the generic character of claim 1 with regard to the Species as identified. Claim 1 through the newly added limitations, exclusively reads on the ninth embodiment. For instance, none of the embodiments other than the ninth, and none of the Figures other than Figure 7 illustrating the ninth embodiment, teach or show both the undoped layer recited in line 15 and the undoped layer recited in line 21 (final line) of claim 1.

### ***Claim Objections***

1. **Claim 1** is objected to because of the following informality: in line 11, the wording: "a layer for preventing exfoliation" should be replaced by "a preventing layer for preventing exfoliation". Appropriate correction is required.
2. **Claim 2** is objected to because of the following informality: the wording "determination" in line 2 should be replaced by: determining". Appropriate correction is required.
3. **Claim 15** is objected to because of the following informality: the wording: "the AlGaAs layer is added with" should be replaced by: "to the AlGaAs layer is added".
4. **Claim 17** is objected to because of the following informality: the wording: "the AlGaAs layer is added with" should be replaced by: "to the AlGaAs layer is added".

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. **Claims 1, 3, 5, 7, 9, 11, 19 and 21-23** are rejected under 35 U.S.C. 103(a) as being unpatentable over Konno et al (JP-2002-344017) (see IDS, also see computerized translation provided with this action and to which

reference is made) in view of Kuo et al (US 2002/0104997 A1) and Chen et al (US 2002/0137244 A1).

*Konno et al teach* a light emitting diode comprising:

a semiconductor substrate **1** (English abstract, "Solution");

a light-emitting region **12** including an active layer **3** provided between a first conductivity type cladding layer **2** and a second conductivity type cladding layer **4** (loc.cit.);

a transparent conductive film **7** made of a metal oxide (indium-tin-oxide or ITO: [0033] in computerized translation) and located over the light-emitting region;

a first electrode **9** ([0024]) on the upper side of the transparent conductive film;

a second electrode **10** ([0024]) formed on the whole or a part of the bottom of the semiconductor substrate;

and a (preventive) layer **6** of AlGaAs (Abstract, "Solution") capable to prevent exfoliation in comparison with the prior art by virtue of having a high impurity concentration (namely: greater than  $10^{18} \text{ cm}^{-3}$ ) (col. 4, l. 53-58), hence having a high carrier concentration, being made of a *compound* semiconductor containing at least aluminum, in one embodiment AlGaAs with  $>0.8 \text{ Al}$  (see final sentence of Abstract, "Solution") and located between the second conductivity type cladding layer **4** and the transparent conductive film **7**. Applicant is reminded that the limitation "for preventing...." constitutes functional language. In reference to said limitation, intended use and other types of functional language must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the

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claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In re Casey, 152 USPQ 235 (CCPA 1967); In re Otto, 136 USPQ 458, 459 (CCPA 1963). In the underlying case, said layer 6 is indeed capable of performing the intended use because of its definition in an embodiment as a compound AlGaAs layer, with a molar ratio of Ga adjusted to be not more than 0.2 (see final sentence of abstract).

*Konno et al do not necessarily teach the limitations*

(a) "and an undoped layer or layer of low carrier concentration formed between the active layer and the second conductivity type cladding layer, wherein the undoped layer or low carrier concentration layer is a layer other than the active layer and comprises a bandgap greater than the active layer"; nor the limitation

(b) "a second conductivity type contact layer formed between the second conductivity type cladding layer and the preventing layer; and an undoped layer inserted into the second conductivity type contact layer".

*However, it would have been obvious to include said limitation (a) in view of Kuo et al, who, in a patent on an LED with an AlGaInP active layer (see "Summary of the Invention", [0011]-[0016])), hence analogous art, teach the selection of a multiple quantum well (for instance, 212: see also [0030]) for active layer, thereby significantly increasing the light emission efficiency (see [0038]). Please note that any active layer in any light emitting diode inherently has at most a low doping concentration, as otherwise electrons and holes could not coexist. Furthermore, inherently, said multiple quantum well layer is a multi-layer of individual quantum well layers, each of these being active*

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layers in their own right, while a single quantum well layer is surrounded both from the bottom and the top by a barrier layer of higher bandgap than that of the individual quantum well layer (see e.g., Fukuda, "Optical Semiconductor Devices", pages 82-84). Hence the barrier layer meets the claim limitation on the claimed undoped or low carrier concentration layer formed between the active layer and the second conductivity cladding layer, while any of the individual quantum well layers meets the claim limitation on active layer.

Motivation derives directly from the higher light output efficiency achievable by selection a multiple quantum well for the active layer structure. As an immediate and inherent consequence the light emitting diode has more than one active layer, hence has one active layer as claimed in line 3 of claim 1 by Applicant, in particular any of the active layers in the multiple quantum well except the topmost active layer, and the claimed "undoped layer or low carrier concentration layer formed between the active layer and the second conductivity type cladding layer" is met by any of the additional active layers on said one active layer.

*Furthermore, with regard to limitation (b) as defined above, it is first observed that Konno et al do teach a p-type (second conductivity type) AlGaAs layer 5 ([0019]) interposed between the second conductivity type cladding layer and the preventing layer (i.e., between 4 and 7) so as to shape the current distribution. In said layer, dispersing and shaping the spatial distribution of the current density, it would have been obvious to include an undoped layer, in particular a dielectric layer, in view of Chen et al, who, in a patent application drawn to the manufacture of optoelectronic devices,*

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especially light-emitting diodes (title, abstract and [0001]-[0006], hence analogous art, teach the inclusion of an insulating or semi-insulating layer **79** ([0039]) as a current blocking layer **in a p-type AlGaAs layer 66** providing good contact ([0031]), for blocking current to flow right underneath the top electrode 78 ([0039]). The adjective “undoped” is met structurally by insulating and semi-insulating layers, while only the structural implications of said adjective have any patentable weight: Applicant is reminded in this regard that a process limitation is only of patentable weight in as much as the method steps distinguish the final structure, and to the extent not impacting final structure are taken to be product-by-process limitations and non-limiting. A product by process claim is directed to the product per se, no matter how they are actually made. See *In re Fessman*, 180 USPQ 324, 326 (CCPA 1974); *In re Marosi et al*, 218 USPQ 289, 292 (Fed. Cir. 1983), and *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir. 1985), all of which make clear that it is the patentability of the final structure of the product “gleaned” from the process steps that must be determined in a “product-by-process” claim, and not the patentability of the process. See also MPEP 2113. Moreover, an old or obvious product produced by a new method is not a patentable product, whether claimed in “product by process” claims or not.

Motivation to include the teaching by Chen et al in the invention by Konno et al derives at least from the resulting concentration of current and hence light emission in an area excluding the area just beneath the top electrode, which prevents the loss of efficiency due to absorption or reflection of light by said top electrode 9.



*On claim 3:* the preventing layer by Konno et al has a thickness of 30 nm ([0029]), hence 300 nm or less.

*On claim 5:* the transparent conductive film by Konno et al is made of indium tin oxide ([0020]).

*On claim 7:* the "preventing" layer is made of an arsenic compound, namely AlGaAs (a/o) ([0021]).

*On claim 9:* the light emitting region by both Konno et al and Kuo et al is made of  $(\text{Al}_x\text{Ga}_{1-x})_y\text{In}_{1-y}\text{P}$  (see [0018] in Konno et al and [0030] in Kuo et al).

*On claim 11:* the preventing layer is an  $\text{Al}_{1-x}\text{Ga}_x\text{As}$  layer with  $x$  not exceeding 0.2 (see English abstract, final sentence), and hence meets the limitation.

*On claims 19 and 21:* the further limitations of claims 19 and 21 fail to further limit the light emitting diode but instead only limit its method of making. The limitations are only of patentable weight in as much as the method steps distinguish the final structure, and to the extent not impacting final structure are taken to be product-by-process limitations and non-limiting. A product by process claim is directed to the product per se, no matter how they are actually made. See *In re Fessman*, 180 USPQ 324, 326 (CCPA 1974); *In re Marosi et al*, 218 USPQ 289, 292 (Fed. Cir. 1983), and *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir. 1985), all of which make clear that it is the patentability of the final structure of the product "gleaned" from the process steps that must be determined in a "product-by-process" claim, and not the patentability of the process. See also MPEP 2113. Moreover, an old or obvious product produced by a new method is not a patentable product, whether claimed in "product by process" claims or not.

*On claim 22:* the transparent conductive film by Konno et al is made of indium tin oxide (ITO) ([0020]).

*On claim 23:* the light emitting region is made of  $(\text{Al}_x\text{Ga}_{1-x})_y\text{In}_{1-y}\text{P}$  ([0018] and [0030]).

2. **Claims 2, 4, 6, 8 and 10** are rejected under 35 U.S.C. 103(a) as being unpatentable over Konno et al, Kuo et al and Chen et al as applied to claim 1 and further in view of Tsuda et al (US 2005/0095768 A1). As detailed above, claim 1 is unpatentable over Konno et al in view of Kuo et al and Chen et al.

*On claim 2:* Konno et al nor Kuo et al nor Chen et al necessarily teach the further limitation defined by claim 2. However, it would have been obvious to include said further limitation because impurity concentrations of  $10^{19} \text{ cm}^{-3}$  are evidently common in the art of making contact regions, as witnessed by Tsuda et al, citing a value of  $10^{20} \text{ cm}^{-3}$  for said impurity concentration ratio for a p-side GaN contact doped with Mg (see [0143]). *Motivation* to select AlGaAs in the case of the application to GaAs based light emitting diodes and the selection of an impurity concentration well over  $10^{19} \text{ cm}^{-3}$  thus is seen to involve only ordinary skills in the art. Applicant is reminded in this regard that it has been held that mere selection of known materials generally understood to be suitable to make a device, the selection of the particular material being on the basis of suitability for the intended use, would be entirely obvious. In re Leshin 125 USPQ 416.

*On claim 4:* the preventing layer has a thickness of less than 300 nm or less, namely: 30 nm (Konno et al, [0029]).

*On claim 6:* the transparent conductive film by Konno et al is made of indium tin oxide (Konno et al, [0020]).

*On claim 8:* the "preventing" layer is made of an arsenic compound, namely AlGaAs (a/o) (Konno et al, [0021]).

*On claim 10:* the light emitting region (by both Konno et al and Kuo et al) is made of  $(\text{Al}_x\text{Ga}_{1-x})\text{In}_{1-y}\text{P}$  ([0018] in Konno et al, [0030] in Kuo et al).

3. **Claim 13** is rejected under 35 U.S.C. 103(a) as being unpatentable over Konno et al, Kuo et al and Chen et al as applied to claim 11 above, and further in view of Tsuda et al (US 2005/0095768 A1). As detailed above, claim 11 is unpatentable over Konno et al in view Kuo et al and Chen et al. None of these references necessarily teach the further limitation as defined by claim 13. However, impurity concentrations of  $10^{19} \text{ cm}^{-3}$  are evidently common in the art of making contact regions, as witnessed by Tsuda et al, citing a value of  $10^{20} \text{ cm}^{-3}$  for said impurity concentration ratio for a p-side GaN contact doped with Mg (see [0143]). *Motivation* to select the claimed range of carrier concentration immediately derives from the suitability of said range for the purpose of providing contact function. Applicant is reminded that the selection of the particular material being on the basis of suitability for the intended use, would be entirely obvious. In re Leshin 125 USPQ 416.

4. **Claims 15 and 17** are rejected under 35 U.S.C. 103(a) as being unpatentable over Konno et al, Kuo et al and Chen et al as applied to claim 11 above, and further in view of Okazaki et al (6,495,862). As detailed above, claim 11 is unpatentable over Konno et al in view of Kuo et al and Chen et al. None of these references necessarily

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teach the further limitation defined by claim 15. However, as shown by Okazaki et al the use of Mg (or Zn or C a/o) as metal dopants of a p-type contact layer for the prevention of exfoliation has long been recognized in the art of light-emitting diodes (col. 6, l. 4-40) (note AlGaAs contact layers are alternatively included in Okazaki's teaching: col. 13, l. 8-25). *Motivation* to include the teaching by Okazaki et al at least derives from the success in the anneal step described in col. 6 to accomplish a high impurity concentration and a consequent strong reduction in resistivity of the ohmic contact. With regard to claim 17: the additional limitation in comparison with claim 15, namely that "C is autodoped" fails to further limit the light emitting diode as final structure but instead merely limits a making of making.

### ***Response to Arguments***

Applicant's arguments filed 6/12/06 have been fully considered but they are not persuasive. Applicant substantially amended all claims, requiring further consideration and search, and resulting in substantially different art over which the claims are rejected. Arguments on page 6 of Remarks by Applicant are therefore moot. They are additionally moot because they rely exclusively on an alleged failure of the adequacy of said rejections when applied to the newly and substantially amended claims including the newly added limitations.

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Johannes P. Mondt whose telephone number is 571-272-1919. The examiner can normally be reached on 8:00 - 18:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jack W. Keith can be reached on 571-272-6878. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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JPM  
March 26, 2007

Primary Patent Examiner:  
  
Johannes Mondt (Art Unit: 3663)